Three-Dimensional Health Monitoring of Sandwich Composites, Phase I

Completed Technology Project (2008 - 2008)

Project Introduction

This SBIR project delivers a single-chip structural health-monitoring (SHM) system that uses the impedance method to monitor bulk interiors and wave propagation methods to assess surfaces. This Three-Dimensional Health Monitoring (3DHM) unit supports nondestructive evaluation (NDE) systems and evaluates hard shell composites that include sandwich structures. Implications of the innovation Increasingly demanding weight and performance needs move manufacturers to the use of composite materials. New systems are needed to detect incipient damage in composites and identify aging-related hazards before they become critical. Three-dimensional health analyzers that actively examine both bulk interiors and large-scale surface areas address a major problem domain; however, no practical system exists. We address this deficiency by building on our existing SHM system. Technical objectives 3DHM leverages our previous NASA research in SHM. Our current prototype takes the form of a single custom printed circuit board, and is a TRL 5 unit. We have demonstrated bulk interior and limited surface area coverage in Boeing thermal protection system (TPS) tests and on wind turbine blades--both feature composite materials. We extend our surface coverage by adding wave propagation SHM. Our sensor validation includes computer modeling that generates virtual (simulated) data. Research description Phase 1 establishes feasibility for a single-chip approach that combines the impedance method and wave propagation, and demonstrates damage detection on a model composite. Phase 2 completes, validates and demonstrates single chip operation, and delivers an operational unit. Anticipated results Phase 1 establishes 3DHM feasibility by developing a detailed chip development and verification roadmap. Phase 2 delivers an operational unit that monitors and assesses bulk interiors and surfaces of hard shell composites that include sandwich structures.

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Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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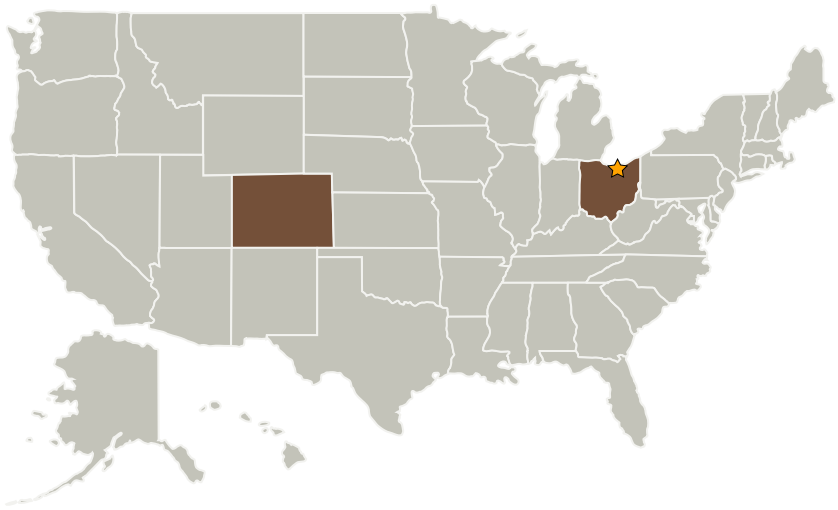
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Extreme Diagnostics, Inc.	Supporting Organization	Industry	Boulder, Colorado

Primary U.S. Work Locations	
Colorado	Ohio

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Robert B Owen

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.3 Thermal Protection Components and Systems
    - TX14.3.5 Thermal Protection System Instrumentation